CHAPTER 2 — Medical

Management and Labor shall support the provision of the comprehensive mandatory annual medical exams as a component of the WFI Program.

This chapter highlights the following:

- **Introduction**
- **Physical Examination**
- **Body Composition**
- **Annual Laboratory Analyses**
- **Vision Evaluation**
- **Hearing Evaluation**
- **Pulmonary Evaluation**
- **Aerobic/Cardiovascular Evaluation**
- **Cancer Screening**
- **Immunizations**
- **Infectious Disease Screening**
- **Referrals to Health Care Practitioners**
- **Written Feedback**
- **Data Collection and Reporting**

INTRODUCTION

The WFI is a progressive model for delivering a preventive and occupational health care services program for today's fire fighters and emergency medical workers (collectively referred to as "uniformed personnel"). The purpose of the WFI is to ensure that uniformed personnel are healthy enough to work safely and effectively during their careers and maintain good health during their retirement. The need for this type of program is based on the unique risks and adverse working environments that uniformed personnel face daily. The intent of the program is that it is implemented as a mandatory, non-punitive program where all uniformed personnel work to improve his or her health or wellness, competing only with themselves.

Due to the physical demands of the job, it is essential that all uniformed personnel maintain a high level of fitness-wellness. In addition, these individual's face unique psychosocial stressors that are a result of the constant exposure to tragic events and suffering. Therefore, the creation of a comprehensive health and wellness program is essential to provide the medical and psychological support needed for uniformed personnel.

Properly implemented, the clinical program outlined in this chapter will allow for an appropriate medical assessment, early detection of diseases and illnesses, as well as implementation of health promotional programs. The annual medical examination is an integral element that provides invaluable health status assessments of both the individual and department wide. Moreover, collecting unidentifiable aggregated data during such exams allows for long-term analysis and the implementation of preventive programs.

Medical Evaluation and Assessment

The medical evaluation outlined in this chapter is intended to accomplish the following to identify whether an individual is physically and mentally able to perform essential job duties without undue risk of harm to self or others; monitor the acute and long-term effects of the working environment of uniformed personnel, including exposure to chemical and biological agents, and the effects of physical and psychosocial stressors in the workplace; detect patterns of disease in the workforce that might indicate underlying work-related health concerns; provide quantifiable medical information on the entire workplace; inform uniformed personnel of their occupational hazards and health status; provide a cost-effective investment in health promotion and disease prevention in the fire service; and to comply with federal, state, provincial and local health and safety requirements.

A comprehensive medical assessment shall be conducted annually and standardized to include all of the components of this chapter. Individuals may use any designated fire department physician, or other providers, to conduct the medical assessment. Uniformed personnel may elect to have certain components of the medical evaluation (i.e. invasive genitourinary examinations) completed by their primary care physician. If this option is chosen, exams given by primary care physicians must be done within the prescribed schedule and the results reviewed by the fire department medical provider and recorded in the member's confidential fire department medical record. All medical assessment results, regardless of where they were obtained or performed, shall remain confidential.

Recently, there have been some varying recommendations on the intervals of medical assessments usually based on an individual's age. However, the value of providing annual medical assessments for uniformed personnel within a high-risk occupation has been determined by the WFI Task Force to be medically significant. It is a cost-effective program, based on a history of saving members' lives through early intervention. The National Fire Protection Association within its health, safety, medical and fitness standards for fire departments has also recognized and specifically requires annual medical assessments.

Medical History Questionnaire

An initial pre-employment history questionnaire for establishing a medical baseline and a periodic medical history to provide follow-up information and to identify changes in health status must be completed during each medical assessment.

Physician Responsibilities

All examining physicians are designated by the department to evaluate patients for the WFI. This continuum of care involves: candidate medical evaluations; annual medical/fitness evaluations; injury/illness care and rehabilitation; pre-retirement medical evaluations (post-retirement exams where provided); and return to work evaluations.

The physician must have a thorough understanding of the positions in the fire department, including: essential job tasks; physical demands; psychosocial stressors; chemical, biological, and physical exposures; and the effects of medical conditions on essential job tasks.

It is important that the physician understand and participate as a member of a multidisciplinary WFI Team. The physician is a vital advisor/consultant to both labor and management on all medical issues.

Physicians must maintain complete adherence to medical confidentiality. Specific information regarding the medical examination, evaluation, laboratory results and medical diagnosis shall not be released unless written permission is obtained from the individual. Employees need to feel assured that the information provided to the physician will not be shared unless consent is granted.

Finally, the fire department physician must have knowledge of local, state, provincial, and federal laws related to health and safety.

PHYSICAL EXAMINATION

■ Vital Signs

A physical examination begins with the assessment of height, weight, blood pressure, temperature, heart rate, and respiratory rate. Blood pressure shall be a part of the baseline and annual examination, with any necessary follow-up as medically indicated. Uniformed personnel with known elevations of blood pressure must be educated about the long-term health effects of ignoring this condition, which includes the possibility of stroke and coronary artery disease.

■ Head, Eyes, Ears, Nose, and Throat (HEENT)

This examination offers an opportunity for the examiner to assess each person's ability to wear head protection, a respirator face piece, and other respiratory protection. The examiner should also review the importance of an uncompromised airway while wearing a respirator. Moreover, it allows for identification of possible chronic exposures that may place the individual at risk for long-term illnesses. The HEENT exam should emphasize early identification of treatable disease and prevention strategies through education. It is also important to note that the examiner has an opportunity to discuss the health hazards of tobacco such as: cancer; cardiovascular disease; lung diseases; premature aging, and tobacco cessation strategies.

The HEENT exam includes a thorough evaluation of: **head** — evaluate the shape of a member's face looking for evidence of previous trauma or other gross abnormality that may interfere with the use of SCBA or other Personal Protective Equipment (PPE); **eyes** — assess extra ocular movements, pupillary light reflex and accommodation, conduct fundi/retinal exam, assess visual acuity, peripheral vision, and color vision; **ears** — visualize the external ear canal and tympanic membrane, inspect the external ear helix particularly for evidence of sun damage or cancerous lesions, and an audiometric exam performed according to standard procedures is also required; **nose** — inspect for patency of nares, septal cartilage deviation, evidence of polyps (usually secondary to chronic inflammation), other mucosal changes (e.g., erythematous patches in smokers), and evidence of tenderness over the paranasal sinuses; **throat** — evaluate the oropharyngeal cavity, gums, teeth, palate (hard and soft), tongue (dorsum and undersurface), tonsils and posterior pharyngeal wall, also direct observation for pre-cancerous changes (e.g., color changes-leukoplakia, plaques, nodules, and asymmetry) is important.

■ Neck

The exam should include evaluation of major vessels, lymph nodes, endocrine structures (salivary and thyroid glands), physiologic functioning (e.g., swallowing, saliva production), assess for abnormal masses, gland enlargement, or suspicious skin lesions. Range of motion of the cervical spine should also be noted.

■ Cardiovascular (CV)

The CV exam must include: assessments of pulse (rate, regularity, and volume); seated blood pressure (with the patient's feet on the floor and the proper sized BP cuff); auscultation of the heart (for heart sounds, extra sounds, clicks, and murmurs) and major arteries (carotid, abdominal aorta, femoral for bruits); and if clinically indicated, examination for signs of decompensating heart function (CHF) such as jugular venous pulse and peripheral (ankle) edema. In addition, a medical assessment must include a thorough history and physical exam. It is imperative to inquire if there are any recent changes in the patient's aerobic capacity, which could indicate pulmonary or cardiac disease. Typically, uniformed personnel suffering from early lung or heart disease will deny being more fatigued while fighting fires. More common is the complaint that during the past year or two the individual's tolerance for exercise has diminished.

The examiner must identify **modifiable** cardiac risk factors such as: smoking; dyslipidemias (including: high total cholesterol/HDL-cholesterol ratio, high LDL-C, high triglycerides, and low HDL-C); hypertension; diabetes; chronic renal failure; metabolic syndrome (insulin resistance syndrome); sedentary lifestyle and/or obesity; and nutritional concerns and/or deficiencies.

Non-modifiable cardiac risk factors should also be noted, such as: male gender; advanced age; and positive family history of premature cardiovascular diseases or risks. For example, individuals with a family history of premature CAD in a first-degree relative are at an increased risk of cardiovascular events.

Pulmonary

A pertinent history includes any complaints of exercise intolerance, cough, symptoms of bronchospasm, and exposures (chemical or biological). The respiratory exam should include: an inspection for respiratory rate and effort; presence of coughing or sneezing; skin color and any clubbing of the digits (indicative of respiratory diseases); auscultation for breath sounds and any abnormal sounds (expiratory wheezing, inspiratory crackles, or stridor); and if clinically indicated, more specific exams for areas of consolidation or dullness (pneumonia, pleural effusions, etc.). Spirometry is an effective screening and surveillance exam for pulmonary disease and shall be included in the exam. Any changes in the spirometric indices, such as reductions in the vital capacity and/or forced expiratory volumes should be subject to further evaluation by more formal pulmonary function testing and/or evaluation by a pulmonologist.

Gastrointestinal

Gastrointestinal exam shall include inspection, palpation, percussion, and auscultation. Abdominal obesity has been shown to be associated with increased inflammation in the body and concomitant increased risk for several chronic diseases. Palpation for tenderness, organ enlargement, other masses (tumors or hernias), and femoral lymph node enlargement is appropriate. Percussion and palpation of major arteries for bruits and pulse volume (specifically abdominal aortic aneurysms, or weak pulses indicative of arterial atherosclerosis) should also be performed. Generally, the right upper quadrant is palpated for evidence of liver, colon or gall bladder disease; and the left upper quadrant is palpated for spleen or colon pathology. Palpating the right and left lower quadrants is helpful for evaluation of colon disease.

Genitourinary

- *Men* — this examination includes testicular, penis, and inguinal hernia evaluations, as well as previously mentioned palpation of femoral pulses and for lymphadenopathy. This part of the examination provides an opportunity for the examiner to discuss the merits of testicular and prostate cancer screening, and techniques for self-examination of the testicles. This exam may be deferred if the patient prefers to obtain these exams from his own primary care physician.

- *Women* - this examination includes vaginal and bimanual pelvic exams, the Pap smear, breast exam, and mammography. This part of the examination provides an opportunity for the examiner to discuss the merits of breast and cervical cancer screening and techniques for self-examination of the breasts. This exam may be deferred if the patient prefers to obtain these exams from her own primary care physician or women's health care facility.

Rectal

The purpose of this procedure is to screen for rectal masses, mucosal abnormalities such as hemorrhoids, anal fissures, and cancerous lesions, and to detect prostate abnormalities in men. All uniformed personnel shall receive annual digital rectal exams (DRE) for detection of lower intestinal masses, prostate gland enlargement (men), atypical prostate tenderness, or surface irregularities and nodules.

Lymph Nodes

An examination of the lymph nodes for enlargement, tenderness, and mobility in the cervical, supraclavicular, inguinal, and the axillary regions is to be conducted.

Neurological

The neurological examination for uniformed personnel shall include a general assessment of mental status, cranial nerve function, motor system, sensory system, cerebellar function/coordination, balance and gait, and reflexes.

- ***Mental Status Exam*** — a general mental status exam focuses on orientation, memory (short and long term), and judgment. If clinically indicated refer for psychiatric and/or psychological evaluation for addition assessment.

- ***Cranial Nerves Exam*** — a focused cranial nerve examination includes an emphasis on the senses. The cranial nerve exam includes: CN1-smell (often omitted unless history of head trauma or toxic inhalation); CN2-vision; CN3-pupillary constriction; elevation of the eyelid; extra ocular eye movements; CN4-extraocular eye movement; CN5-jaw movement; CN6-extraocular eye movements; CN7-muscles of the face; CN8-hearing and balance; CN9-taste; pharynx movements; CN10-movement and sensation in the oropharynx; CN11-movement of the neck muscles; and CN12-tongue movement. A more thorough evaluation may be necessary if clinically indicated (e.g., headaches, dizziness/vertigo, or syncope).

- ***Peripheral Nerve Exam*** — peripheral nerve function is assessed in the motor and sensory portions of the neurological exam. Decreases and imbalances in muscular power can predispose uniformed personnel to musculoskeletal injuries. Thus, a general (motor assessment as measured by a 0 to 5 subjective rating of power) is important as it pertains to safe and injury-free work performance. The peripheral neurological examination is usually continuous with the cranial nerve evaluation. However, such peripheral motor, sensory, and reflex ex-

aminations may be conducted in conjunction with the musculoskeletal exam.

Motor — gait, heel-to-toe, and Rhomberg (feet together, arms outstretched, palms up and eyes closed) screening examinations for cerebellar function must be conducted. Muscle strength is tested in all major muscle groups. Because of the physical demands on fire fighters, any evidence of decreased muscle strength (as measured on the standard 0-5 scale) raises significant concerns regarding work performance and must be addressed.

Sensory — the examination includes pain, thermal sensation, light touch, position, two point discrimination, and vibratory sensation testing. Thermal evaluations are generally omitted if the pain examination is normal.

Reflexes — this examination includes the standard evaluation of reflexes on a 0-4+ scale, including the ankle, knee, bicep, tricep, and brachioradialis.

■ Musculoskeletal

In addition to the motor assessment, the examiner inspects and palpates for: structural asymmetries (e.g. areas of muscular imbalance and atrophy); active range of motion of all major joints (including the back); the sensation of pain with any of the above; and a complete joint specific examination where clinically indicated. Any musculoskeletal limitations or areas of pain are important to note, not only for the timely provision of physical therapy, but to record those injuries that may be relevant to future workers' compensation, pension, or disability claims.

■ Skin

The examiner shall inspect the skin for color, vascularity, lesions, and edema. Careful examination of the skin for abnormal/atypical nevi (moles) or other suspicious lesions that could be cancerous (non-melanoma or melanoma types) is critical. The clinician should have a low threshold for referring a patient to a dermatologist when suspicious or atypical changes are present. Also note any rashes, scars, tattoos, or obvious evidence of trauma/injury (bruising, excoriations, scraps, cuts, swelling, erythema, warmth, or tenderness).

BODY COMPOSITION

Body composition differentiates between the relative amounts of adipose tissue (fat) and lean body mass. Lean body mass consists of muscle, bone, organs, nervous tissue, and skin. Body fat is traditionally thought of as a passive tissue that serves to insulate and protect the body and its organs, and as a reservoir for energy storage. Although some body fat is considered essential, excess body fat increases the workload and amplifies heat stress by preventing the efficient dissipation of heat when a person exercises. In addition, added body fat elevates the energy cost of weight-dependent tasks such as climbing ladders and walking up stairs, also contributing to injuries and an increased risk of many chronic diseases. Obesity is overtaking smoking as the number one cause of preventable deaths and is associated with an increase in almost every chronic disease including but not limited to: cardiovascular disease, hypertension, dyslipidemia, heart failure, diabetes, several types of cancer, asthma and chronic lung diseases, obstructive sleep apnea, dementia, arthritis, and gastroesophageal reflux disease.

■ Evaluation of Body Composition

Methods for evaluating body composition include: circumferential measurements, hydrostatic weighing, Bod Pod, bioelectrical impedance analysis (BIA), skinfold measurement, and body mass index (BMI).

The accuracy, reliability and practicality of these methods vary. There is ongoing research on the most accurate and consistent method for evaluating body composition. However, the WFI has selected the skinfold measurement evaluation as the preferred method of estimating body composition.

■ Distribution of Body Fat

Recent scientific research suggests that the distribution of body fat is an important predictor of negative health outcomes. Individuals with more intra-abdominal/visceral fat, which is fat around abdominal organs, are at an increased risk of hypertension, type 2 diabetes, dyslipidemia, coronary artery disease, and premature death. This visceral adipose tissue is metabolically different than subcutaneous fat. Excessive abdominal fat, as revealed by waist circumference measures, creates increased inflammation in the body. This occurs because fat cells release pro-inflammatory cytokines, cell signaling molecules that activate the immune system, which 'turns on' an inflammatory cascade at genetic and cellular levels, ultimately affecting the entire body. This is important because current scientific research links chronically increased inflammation to several chronic disease states such as cardiovascular disease, prediabetes/diabetes, cancer, and dementia, and others.

Thus, abdominal fat is no longer thought of as just a passive or inert reservoir for storing energy; it is an active endocrine organ, secreting many factors capable of increasing systemic inflammation within the body. Expert consensus indicates that a waist circumference measurement, measured at the level of the iliac crests, that is greater than 102cm (40 inches) in men, and 88cm (35 inches) in women imparts a significant increase in the risk of chronic disease, including cardiovascular disease. Obesity, and in particular abdominal obesity, is a health risk that must be managed aggressively.

ANNUAL LABORATORY ANALYSES

Prior to reporting to a physician for an annual medical examination, uniformed personnel may have their blood drawn and urine sampled and analyzed at a designated laboratory site. Having the lab results available at the time of the physical exam will assist physicians in providing a more thorough examination and allowing physicians to address any concerns based on the laboratory results. If blood is drawn and urine sampled during the annual examination, results are provided to physicians for a follow-up and/or addressed in the Health Risk Appraisal.

■ Blood Analysis

The following are components of the blood analysis. At a minimum, laboratory services must provide these components in their automated chemistry panel (CMP) and complete blood count (CBC) protocols. If laboratory tests are not done prior to the scheduled physical examination, laboratory tests will be drawn at the time of the medical examination.

Blood drawn for medical analysis *will not* be used for drug screening at any time.

The minimum blood analysis to be conducted as a part of the annual medical examination, includes: white blood cell count (with differential); platelet count; red blood cell count (hemoglobin and hematocrit; liver enzymes (AST, ALT, LDH) and function (alkaline phosphatase, bilirubin, albumin) tests; glucose — fasting; creatinine and glomerular filtration rate (GFR); blood urea nitrogen; sodium; potassium; carbon dioxide; total protein; calcium; lipids (cholesterol and triglycerides) — fasting

• ***White Blood Cell Count***

White blood cells (WBC) are an important part of the body's immunologic system. The role of white blood cells is to help the body defend itself against infection.

An elevated WBC count may suggest an acute bacterial or viral infection, various leukemias, acute blood loss, renal failure, pregnancy, or an inflammatory disorder (such as inflammatory bowel disease), or it may indicate the effects of acute severe emotional/physiological (e.g., burns, trauma) stress on an individual. Situations where the WBC count is low can include: chronic viral or bacterial infection, acute leukemias, immunosuppressive disorders (e.g., HIV), autoimmune diseases (e.g., lupus), chemical and heavy metal toxicities, drug effects (e.g., some antibiotics and analgesic medications), and perhaps chronic emotional stress (which could be construed as 'normal' depending on the circumstances of the individual). The WBC differential helps to determine the significance of an abnormal WBC count.

• ***Differential***

The WBC differential identifies relative amounts of different types of white blood cells and helps to identify different clinical problems. For instance, a high neutrophil count might indicate: an acute bacterial infection; presence of immature neutrophils (bands) could mean acute leukemia; excess eosinophils may indicate a parasitic infection or allergic reaction; or an increase in lymphocytes may indicate a chronic inflammatory condition, infection or chronic type of leukemia.

• ***Red Blood Cell Count***

The purpose of red blood cells is to carry oxygen to the body's tissues. The routine measures of the blood's oxygen carrying capacity are hemoglobin and hematocrit. An increase in the number of RBC's may indicate dehydration, a myeloproliferative disorder called polycythemia, or conditions of hypoxia such as emphysema and smoking. Decreased levels may indicate anemia, acute blood loss, or hemodilution.

• ***Platelet Count***

Platelets are essential to the bloods ability to properly clot. Abnormally low platelet counts, known as thrombocytopenia, may be caused by a decrease in production possibly stemming from bone marrow suppression, clumping or destruction of platelets from sequestration in the tiny capillaries of the spleen. High platelet counts are associated with myeloproliferative disorders such as polycythemia, essential thrombocytosis, or chronic myelogenous leukemia.

• ***Liver Enzymes and Function Tests***

The following liver assessment tests are used primarily to detect and monitor liver disease. These tests measure either liver injury (enzymes, also referred to as liver transaminases) or liver function. An increasingly common cause of elevated liver enzymes is fatty infiltration of the liver, due to obesity, referred to as 'non-alcoholic fatty liver disease.' Abnormal results are caused by many other medical conditions or medical treatments.

Aspartate aminotransferase (AST) — is distributed through many tissue types with high concentrations in liver, heart, skeletal muscle, and kidney. It is elevated in liver conditions of infection (hepatitis), obstruction (e.g., gall bladder stones), cirrhosis, fatty infiltration, myocardial stress (acute MI, infection, heart failure), skeletal muscle trauma or vigorous exercise, medication use (e.g., acetaminophen or isoniazid), or alcoholism. Low levels are due to vitamin B6 deficiency, renal failure, or protein deficiency/malabsorption.

Alanine aminotransferase (ALT) — is typically elevated in liver disease, although there are small amounts of this enzyme in heart, kidney, and muscle

tissues. It is more liver specific than is AST. Typically alcoholism, hepatitis, obstructive jaundice, liver cancers, cirrhosis, acute MI, trauma to skeletal muscle, and salicylate (ASA) toxicity can cause ALT elevation.

Lactate dehydrogenase (LDH) — is an enzyme present in all cell types and is released when they are damaged. It is elevated in liver disease, malignancy, hemolytic anemia (rupture of red blood cells), pulmonary infarct, muscular or myocardial injury, or trauma.

Alkaline phosphatase (Alk Phos) — is present in high concentrations in growing bone and in bile. It is elevated in diseases involving the liver, especially any disease process that impairs bile formation or flow (e.g., hepatic duct blockage with stones, metastatic carcinoma of liver), thus it is a liver 'function' test. Diseases of the bone (e.g., bone metastases, Paget's disease, osteomalacia, rickets, hyperparathyroidism, healing fracture, or myositis ossificans) also increase this enzyme. Decreased levels might indicate hypothyroidism, very low fat/low protein diets, zinc deficiency, excessive vitamin D intake, or blood type A.

Bilirubin — is formed when RBC's break down and release their bilirubin (heme metabolism), which is then conjugated in the liver for excretion in the bile. High levels of bilirubin in the blood may be due to abnormalities of formation, transport, metabolism, and excretion. This makes bilirubin a liver 'function' test. Jaundice results from high bilirubin concentrations in the serum. Elevated bilirubin levels are classified as unconjugated or conjugated hyperbilirubinemias. Unconjugated (indirect) hyperbilirubinemias are caused by: increased bilirubin production (e.g., hemolytic anemias or reactions); impaired bilirubin uptake by the liver (due to certain drugs); or impaired conjugation (Gilbert's disease is a common cause of elevated bilirubin which is caused by a decreased level of a conjugation enzyme). Conjugated (direct) hyperbilirubinemias result from: impaired excretion of bilirubin from the liver due to hepatocellular disease (hepatitis, cirrhosis); intrahepatic cholestasis (blockages within the liver) from drugs, sepsis, and hereditary cholestatic syndromes; or extrahepatic biliary obstruction.

Albumin — is a protein made by the liver, thus it is a liver 'function' test. Decreased levels of albumin can be the result of: liver disease or dysfunction (e.g., hepatitis, cirrhosis, necrosis, fatty liver); malnutrition; malabsorption; alcoholism; some chemical and heavy metal toxicities; systemic infections; chronic inflammation; insulin resistance; obesity; autoimmune diseases; renal diseases (nephrotic syndrome, glomerulonephritis); congestive heart failure; overhydration; leukemia; or pregnancy. Albumin may be high with dehydration, shock, and prolonged tourniquet use during venipuncture, and with steroid therapy.

• Glucose

Glucose in adequate levels is essential for all normal body functions. Cells use glucose as a fuel substrate for the production of adenosine triphosphate (ATP), the basic source of energy used in all metabolic reactions — both anabolic (synthetic reactions that convert simple molecules into larger more complex molecules) and catabolic (reactions that breakdown or degrade larger molecules into simpler ones). Insulin is a hormone that regulates glucose metabolism. Diabetes results from a lack of insulin, a lack of sensitivity to insulin or both. Blood glucose may be tested in a multistep process to determine if one has diabetes or is at risk of developing diabetes. Fasting blood glucose levels are easier to interpret than are random levels although both measurements may be useful in the diagnosis of diabetes.

• Creatinine (Cr)

This is a measure of renal function. It is a product of muscle metabolism that is produced in the blood stream at a relatively constant rate and cleared by renal excretion. The kidney filters blood through millions of sieves, glomeruli, which retain essential components of the blood in the body followed by selectively reabsorbing anything that was missed by the glomeruli in the renal tubules. Creatinine is freely filtered by the kidney and not reabsorbed by the renal tubules. It is not a perfect indicator of renal function as other factors can alter serum creatinine measurement. Conditions causing elevation of creatinine include: the use of drugs, such as aspirin, cimetidine, trimethoprim, cephalothin, and cefoxitin; ketoacidosis; and increased protein intake or muscle mass. Conditions causing decrease of creatinine include: advanced age due to physiological decrease in muscle mass; cachexia, due to pathological decrease in muscle mass caused by cancer and malnutrition; and liver disease, due to a decrease in hepatic creatinine synthesis and cachexia.

• Glomerular Filtration Rate (GFR)

This is the best index of overall kidney function and is a more sensitive, and early, indicator of kidney dysfunction than creatinine alone. Creatinine clearance, done with 24 hours of urine collection, is the usual means of estimating GFR. Urine collection for a full 24 hours is impractical for patients and prone to error. Many laboratories now estimate GFR using the modified MDRD GFR equation which uses the patient's age, gender, race, and measured serum creatinine level. This estimate of GFR is often included with the serum creatinine on the laboratory results chart.

• Blood Urea Nitrogen (BUN)

Urea is another useful index of renal function. It is synthesized mainly in the liver and is the end product of protein catabolism. The kidney excretes this nitrogenous waste

product of protein catabolism. Kidney damage reduces its excretion and is a marker of renal failure and disease.

Urea is freely filtered by the kidney with approximately 30-70 percent being reabsorbed in the renal tubules, but is dependent upon the hydration status of the individual. The reabsorption of urea may be decreased in well-hydrated individuals, causing a low BUN level; whereas dehydration causes increased reabsorption causing a higher BUN level, as is often seen after a prolonged fast with little water intake.

A normal BUN: creatinine ratio is 10:1; with dehydration the ratio can increase to 20:1 or higher. There are conditions other than renal disease that affect BUN, independently of GFR. Circumstances which could increase BUN include: conditions that reduce the effective circulating blood volume (e.g. dehydration, congestive heart failure, or acute blood loss/shock); catabolic states (e.g. gastrointestinal bleeding or corticosteroid use); high protein diets; and drugs such as tetracycline, analgesics, or Naiads. Circumstances which could decrease BUN include: liver disease; malnutrition, low protein diet and cachexia; and over hydration.

• ***Sodium***
Sodium is an important electrolyte in the body. Abnormal serum sodium does not necessarily mean a problem with the sodium ion balance, but is most often due to abnormal water balance, generally associated with abnormal serum osmolality and shifts of water across the cell membrane. The most common and complicated disturbance of sodium is hyponatremia, low sodium concentration. Generally it results from water imbalance, not sodium imbalance; and its differential diagnosis starts with measurement of the patient's serum osmolality as low, normal, or high, then determination of their extracellular fluid volume as low, normal, or high. The most common reasons for hyponatremia can include situations where the patient's serum osmolality is low and their volume status is low or normal. If their volume status is low, hypovolemia, it may be the result of: dehydration; vomiting; or diarrhea which causes extrarenal salt losses; certain medications such as diuretics and ACE inhibitors, or in aldosterone deficiencies. If volume status is normal, hyponatremia is usually due to the syndrome of inappropriate antidiuretic hormone secretion (SIADH). Patients who are hypervolemic, in edematous states, with hyponatremia have congestive heart failure, liver disease, nephritic/nephrotic syndrome, or advanced renal failure.

Hypernatremia, high sodium concentration, occurs most commonly when free water intake has been inadequate. This is not an exhaustive list of causes for hypo/hypernatremia and specialist consultation may be appropriate.

• ***Potassium***
Potassium is another important electrolyte in the body, with 95 percent of potassium residing inside cells. The plasma potassium concentration is maintained in a narrow range through two main regulating mechanisms: potassium shift between intracellular and extracellular compartments; and modulation of renal potassium excretion. Potassium levels may be elevated, known as hyperkalemia, in patients taking certain medications that inhibit potassium excretion: ACE inhibitors, angiotensin receptor blockers, potassium sparring diuretics, or their combination. Other medications that can cause hyperkalemia include: NSAIDs, trimethoprim, tacrolimus, and heparin. Otherwise the causes of hyperkalemia involve clinical situations where there is: decreased excretion of potassium, shift of potassium out of cell, spurious causes or if there is excessive intake of potassium.

Low potassium levels, called hypokalemia, in situations where there is decreased potassium intake, potassium shift into the cell (alkalosis, excess insulin, or trauma), renal potassium loss (aldosterone deficiency, therapy with diuretics such as furosemide and thiazides, hypomagnesemia, renal tubular acidosis), or if there is extarenal potassiumloss (vomiting, diarrhea, or laxative abuse). This is not an exhaustive list of causes for hyper/hypokalemia and specialist consultation may be necessary.

• ***Carbon Dioxide (Bicarbonate)***
Carbon dioxide levels are an indicator of the acid-base status of the patient. The measurement of venous carbon dioxide is actually a direct determination of the bicarbonate anion concentration. Therefore, for clinical purposes the total carbon dioxide content is equivalent to the bicarbonate anion concentration. Disturbances in acid-base balance can be caused by a variety of primary metabolic and respiratory disorders (more acute situations), or they can be due to a combination of the two (in more chronic situations where there has been compensation for the primary disorder). Primary respiratory disorders affect blood acidity by causing changes in the arterial partial pressure of carbon dioxide, and primary metabolic disorders are indicated by changes in the bicarbonate anion concentration. The medical workup of the patient with an acid-base disorder is complicated and may require specialist consultation.

• ***Total Protein***
Total protein is a measure of the total proteins in the serum (albumin and globulins). Plasma also contains fibrinogen protein so if the lab result is high, ensure that the serum was measured and not the plasma. Total protein levels can be elevated in chronic infection, chronic liver disease, alcoholism, dehydration, multiple myeloma, lymphoma, and some autoimmune diseases. Levels are low in malabsorption, malnutrition, severe liver disease, chronic renal failure, nephrotic syndrome, overhydration, and protein losing states.

• ***Calcium***

Calcium is measured in the serum or plasma and is required for normal muscle contraction and nerve function. It is the ionized calcium in blood that is usually measured, and any variation from the normal range is usually highly significant. Calcium is usually elevated, known as hypercalcemia, due to primary hyperparathyroidism or a malignancy (e.g., multiple myeloma, lymphoma, or tumors that secrete PTH). These two reasons account for 90 percent of all cases of high calcium. Other causes of hypercalcemia are: increased intake or absorption of antacids or excess vitamin D or A; other endocrine diseases such as adrenal insufficiency, or pheochromocytoma; sarcoidosis; Paget's disease of the bone; drugs such as thiazide diuretics or lithium; and conditions leading to immobilization.

Ionized calcium may be low, hypocalcemia, in conditions where there is insufficient action of PTH (e.g., hypoparathyroism) or active vitamin D. The most common cause for low total calcium is low albumin states (where correction, by the lab or with a formula, of the serum calcium concentration is needed to accurately reflect the ionized calcium concentration). The most common cause of hypocalcemia is renal failure due to decreased production of vitamin D. Other important causes include: decreased intake from malabsorption or vitamin D deficit; increased loss resulting from diuretics or alcoholism; hyperphosphatemia; and sepsis. The medical workup of the patient with hyper/hypo-calcemia can be complicated and may require specialist consultation.

• ***Lipid Tests***

A full lipid panel is a critical component of the laboratory testing profile for the WFI. In the general population, a positive correlation between plasma cholesterol and coronary risk has been well documented. Fire fighters are at an even higher risk of cardiovascular events in the course of their duty, especially during fire suppression. Among fire fighters, almost half of line-of-duty deaths can be attributed to cardiovascular events. Hypercholesterolemia is one of the major modifiable risk factors in efforts to prevent coronary artery disease and cardiovascular events.

> ***Total Cholesterol*** — cholesterol belongs to a larger family of biological chemicals called lipids (fats). Because it is such a critically important substance, a complex carrier system has developed to move cholesterol through the entire body. This system consists of a number of proteins that bind to cholesterol and transport it to where it is needed. Cholesterol, a lipid, when bound together with one of these carrier proteins, is called a lipoprotein. Both total cholesterol and carrier proteins can be measured in blood samples. When looking at total serum cholesterol levels, the risk of developing atherosclerotic coronary vascular disease increases as the total cholesterol level increases.
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> ***Low Density Lipoprotein (LDL-C) level*** — LDL-C is 45 percent cholesterol by weight and is the major carrier of cholesterol to the body's tissues. Since LDL can deliver too much cholesterol to the wrong places (like the heart arteries) resulting in cholesterol plaque build-up, people often refer to this as a bad cholesterol.
>
> ***High Density Lipoprotein (HDL-C) level*** — HDL-C is 30 percent cholesterol by weight and is involved in reverse transport of cholesterol away from body tissues and out of the body. HDL cholesterol removes excess cholesterol from the arteries, helping to prevent the build-up of cholesterol plaques. Because this lipoprotein appears to remove excess cholesterol, it is often referred to as the good cholesterol.
>
> ***Total Cholesterol/HDL Ratio*** — TC/HDL-C ratio gauges relative risk of cardiovascular disease. The importance of the protective effect of HDL cholesterol is emphasized by this ratio. The total cholesterol level may be within a normal range but combined with low HDL cholesterol level, the ratio indicates the individual is at a higher risk than someone with normal total cholesterol and a normal HDL level.

While cholesterol tests are part of the annual examination, the WFI strongly recommends that a fasting lipid profile be conducted at least once every five years. Further, a non fasting total cholesterol > 200 or HDL cholesterol < 40 indicates the need for a fasting lipid profile.

Risk factors for cardiovascular disease that need to be considered in the interpretation of results and in further determining additional fasting lipid profile testing include age $\geq$ 45 years for males and $\geq$ 55 years for women, current cigarette smoking, hypertension, HDL cholesterol below 40 and a family history of premature coronary heart disease defined by a definite myocardial infarction or sudden death before age 55 years in a male first-degree relative and before age 65 in a female first-degree relative. A desirable LDL level in individuals without identifiable coronary heart disease is < 160 mg/dl with zero risk factors and < 130 mg/dl for two or more risk factors. The desirable LDL cholesterol level for those individuals with known coronary artery disease or risk equivalents including symptomatic carotid artery disease, peripheral arterial disease, abdominal aortic aneurysm, and diabetes mellitus is < 70 mg/dl.

Given the increased physiological demand imposed by the fire service, cholesterol lowering therapy including lifestyle modification and medication when necessary is recommended for the achievement and maintenance of desired cholesterol levels.

■ Metabolic Syndrome

Metabolic syndrome also referred to as *syndrome X*, *insulin resistance syndrome*, and *pre-diabetes*, is characterized by dysfunctional metabolic factors probably linked by a common underlying mechanism. From a clinical standpoint, diagnosing the metabolic syndrome identifies individuals who are at increased risk for cardiovascular disease, including coronary heart disease, stroke, and peripheral artery diseases and/or type 2 diabetes.

Metabolic syndrome is characterized by a clustering of risk factors for cardiovascular disease that include: insulin resistance (reduced cellular insulin action); abdominal obesity; atherogenic dyslipidemia (changes to lipids that promote atherosclerosis which include a combination of elevated triglyceride levels and atherogenic low-density lipoprotein (LDL) cholesterol particles; and low levels high-density lipoprotein (HDL) cholesterol); hypertension; hyperuricemia (high serum uric acid); a prothrombotic state (enhanced blood clotting); and a proinflammatory state (increased systemic inflammation). While many factors such as insulin resistance, abdominal obesity, physical inactivity, hormonal imbalances, and a poor diet are likely the prime factors in the development of metabolic syndrome, genetic factors (especially family history of type 2 diabetes) also play a role in its pathogenesis.

Individuals with metabolic syndrome are at increased risk for the development of coronary heart disease and other diseases related to plaque buildup in artery walls, such as stroke and peripheral vascular disease, as well as type 2 diabetes mellitus. Prospective population studies show that compared to individuals without metabolic syndrome, those who have it are at least double the relative risk for cardiovascular disease events, and a 5-fold increase in the risk of developing type 2 diabetes.

Therefore, it is important to identify those with metabolic syndrome and refer for treatment. The metabolic syndrome is identified by the presence of three or more of the following components[4]: abdominal obesity defined as a waist circumference >102 cm (>40 in) in men or >88cm (>35 in) in women; triglycerides ≥150 mg/dL; HDL cholesterol <40 mg/dL for men or <50 mg/dL for women; blood pressure ≥130/85 mmHg; and fasting glucose ≥110 mg/dL.

■ Heavy Metal and Special Exposure Screening

Baseline testing for heavy metals and special exposures may be performed under special circumstances, such as hazardous materials exposures; recurrent exposures; other known exposures; or where under federal, state, or provincial regulations requires it, such as OSHA standards.

The following screenings may be utilized: urine screen assesses exposure to arsenic, mercury and lead; blood screen for lead and zinc protoporphyrin assesses exposure to lead; testing and screening for specific exposure or other heavy metal screens may include aluminum, antimony, bismuth, cadmium, chromium, copper, nickel and zinc; and special blood testing may be ordered for organophosphates, RBC cholinesterase, or other toxic exposures such as blood screening for exposure to PCBs.

■ Urinalysis

Urinalysis will include both dip stick and/or laboratory microscopic evaluations.

The urine sample received for this analysis *is not intended to be and will not* be used for drug or alcohol use screening at any time.

• ***Dip Stick Urinalysis***

pH — is the relative acidic or basic state of the urine can be an indication of infection or chemical exposure.

Glucose — excess glucose is seen in diabetes and renal tubule disease.

Ketones — are abnormally elevated in uncontrolled diabetes, alcoholism, starvation, dehydration, and with some weight reducing diets.

Protein — protein levels in urine can be elevated in kidney or urinary tract diseases including cancers. The clinical significance of elevated protein on dipstick can be determined by performing a 24-hour urine test.

Blood — dip sticks detect hemoglobin from lysed red blood cell and myoglobin. Levels can be elevated with hemolytic anemias, infections, kidney stones, tumors, dehydration, muscle breakdown, and renal disease due to tuberculosis, trauma, glomerulonephritis, or cancer.

Bilirubin — dip sticks may be positive for bilirubin in liver disease, the breakdown of red blood cells, and gallbladder obstruction.

• ***Microscopic Urinalysis***

This includes evaluation for white blood cells (WBC), red blood cells (RBC), WBC casts, RBC casts, and crystals. This testing helps to differentiate various kidney and urinary tract diseases or trauma.

VISION EVALUATION

Assessment of vision must include evaluation of distance, near, peripheral, and color vision. Near visual loss, presbyopia, is common in adults and increases in prevalence with increasing age usually from the mid to late 40s on. Com-

mon visual disorders affecting adults include cataracts, macular degeneration, glaucoma, and diabetic retinopathy.

The visual evaluation must include: visual acuity screening for both far vision acuity and near vision acuity; eyes must to be tested separately; vision testing to determine both uncorrected and corrected visual acuity; color vision testing must be assessed using color plates, such as Ishihara plates; when peripheral vision evaluations are indicated, protocols specific to the test apparatus, not objects in the field, must be utilized.

HEARING EVALUATION

By nature of their occupation, uniformed personnel are at an increased risk for noise-induced hearing impairment at an earlier age. Baseline and annual audiograms are to be performed on all uniformed personnel. To establish trends in hearing acuity, current audiogram must be compared with all previous audiograms, including the baseline. Testing must be done in an ANSI-approved soundproof booth. Pure tones are presented at various intensities until a threshold is established. For the purposes of database collection, the following frequencies are tested: 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz.

In addition, pure tone threshold testing must be performed separately in both ears and participants must not use hearing aids during testing.

PULMONARY EVALUATION

■ Spirometry

A baseline spirometry must be established in all uniformed personnel who may be required to wear breathing apparatus. A baseline is useful in individuals who have a history of respiratory health problems to use for later comparison. Baselines can also be used in individuals without respiratory disease who later develop respiratory impairment again for comparison purposes. Results can vary depending on patient's effort, maximum effort is required, and proficiency of the test administrator, please note the technician performing this test must be certified in the procedure. The member's age, height, gender, and race/ethnicity is used by the technician to optimally calculate and interpret spirometry results. Significant deterioration, greater than 15 percent from the previous year's test indicates further evaluations.

• ***Spirogram***

Only a spirogram that is technically acceptable and demonstrates the best effort by an individual should be used to calculate Forced Vital Capacity (FVC) or Forced Expiratory Volume (FEV_1).

> ***Forced Vital Capacity (FVC)*** — if the FVC is lower than 80 percent of predicted, this may indicate obstructive lung disease, restrictive lung disease, or mixed obstructive and restrictive pulmonary disease.
>
> ***Forced Expiratory Volume (FEV_1)*** — if the FEV_1 is lower than 80 percent of predicted, this may indicate obstructive, restrictive, or a mixed pattern of obstructive and restrictive pulmonary disease.
>
> ***FEV1/FVC Ratio*** — can suggest the presence of the following pulmonary diseases: obstructive lung disease if the FEV_1/FVC ratio is less than 75 percent of predicted; mixed pattern disease if the FEV_1/FVC ratio is between 75 — 85 percent of predicted and both FEV_1 and FVC are reduced; or restrictive lung disease if FEV_1/FVC ratio is greater than 85 percent of predicted and both FEV_1 and FVC are reduced.

Annual spirometry is the only cost effective screening test. The following respiratory tests are used when indicated to further evaluate suspected abnormal conditions and are performed in specialized laboratories.

• ***Peak Expiratory Flow Rate***

A low PEFR may indicate obstructive or restrictive lung disease entities such as asthma or chronic obstructive pulmonary disease (COPD), but is most useful as a simple measurement to monitor asthmatic response to therapy. PEFR can be used at home or work to objectively document a patient's symptomatic complaints.

• ***Pre/Post Bronchodilator***

Obstructive disease and mixed obstruction/restriction usually, but not always, responds to a bronchodilator. Restrictive diseases typically do not respond to a bronchodilator. Repeat spirometry after bronchodilator treatment may provide useful information, but is not required for data collection purposes.

• ***D_LCO***

A measurement of diffusing capacity of carbon monoxide. Low D_LCO, less than 70 percent, is seen in interstitial restrictive lung diseases (e.g., asbestosis and sarcoidosis), chronic CO intoxication, and obstructive lung disease, less than 60 percent emphysema. D_LCO is not reduced in bronchitis or asthma.

• ***Lung Volumes***

Are low in restrictive diseases, interstitial or chest wall, and are high in obstructive diseases especially with emphysema.

■ Initial Baseline Chest X-Ray

A baseline chest X-ray is required and useful for an individual with a history of respiratory problems or symptoms. It is also useful in healthy individuals for later comparison in the event that disease develops.

■ Repeat Chest X-Ray

Unless medically indicated, all uniformed personnel are recommended to have a repeat chest X-ray every five years.

The use of chest x-rays in surveillance activities in the absence of significant exposures, symptoms, or medical findings has not been found to reduce respiratory or other health problems. Among uniformed personnel, chest X-ray abnormality may indicate pneumonia, tuberculosis, lung cancer, or other occupational lung disease.

AEROBIC/CARDIOVASCULAR EVALUATION

■ Resting ECG

A resting 12-lead ECG shall be performed annually. It can be useful to diagnose disturbances in rhythm, presence of conduction defects (e.g., heart blocks), or indications of ischemic heart disease (e.g., ST segment depression or elevation, T-wave inversions, or Q-waves). Further investigation may be necessary if any abnormality is seen, or if there is a significant change in the ECG from the previous year(s).

■ Aerobic/Cardiopulmonary Testing

A cardiopulmonary test shall be done annually, using either a maximal test under the supervision of a physician or a submaximal test using WFI protocols.

The maximal cardiopulmonary test with ECG is performed in a medical facility with proper monitoring by a physician and available resuscitation equipment.

Cardiopulmonary/aerobic tests with heart rate monitoring, rather than ECG monitoring, are conducted on a treadmill or stairmill using the validated protocols contained in Appendix A. Diagnostic information and a calculated VO_2 is obtained from these submaximal tests.

CANCER SCREENING

Appropriate screening examinations: skin, clinical breast examination, Pap smear, testicular, examination, Digital Rectal Exam (DRE), Fecal Occult Blood Testing (FOBT), colonoscopy, and bladder cancer examination must be conducted with the annual examination or as indicated below. When such examinations are carried out on a member of the opposite sex or if the member requests, a second health care worker chaperone should be in the room for patient support and medico-legal reasons. Uniformed personnel may, however, choose to have such exams performed by an outside physician. When uniformed personnel use their own physicians for cancer screening examinations, results need to be forwarded to the fire department physician for inclusion in the fire department confidential medical file.

■ Skin Exam

Both melanoma and non-melanoma skin cancers are common and are increasing in incidence. Skin cancer must be diagnosed in a timely manner to ensure successful treatment and maximize cure rates. Comprehensive inspection of the skin, especially in sun exposed areas, is necessary. Inform the patient that taking a photograph of their own skin (especially their back) can help when comparing specific nevi (moles) or assessing for new or atypical lesions over time. Any suspicious lesions shall be referred for dermatological assessment.

■ Breast Examination

Breast cancer is the most common type of cancer in women and second leading cause of cancer death in women, after lung cancer. Breast cancer incidence and mortality rates increase with age. An annual clinical breast examination is required. Self examination should be encouraged, and educational information should be made available to interested patients.

■ Mammogram

Annual mammography screening shall be performed on all women uniformed personnel beginning at age 40. Women uniformed personnel with a family history of breast cancer or other personal risks shall be provided with appropriate individualized recommendations for breast cancer screening, such as genetic screening or breast MRI. Women uniformed personnel may wish to have an ongoing clinical association with a women's health provider.

■ Pap Smear

Annual Pap smear screening is recommended to screen for cervical inflammation or cervical cancer. The incidence of invasive cervical cancer has been estimated to have decreased 70 percent by screening. In addition to the Pap test — the main test for cervical cancer — the human papillomavirus (HPV) test may be used for screening women aged 30 years and older, or if indicated at any age for those who have unclear Pap test results.

■ Testicular Examination

Testicular cancer represents 1 percent of all cancers in men. It remains the most common cancer in Caucasian men 20 to 34 years old. In general, an excellent prognosis exists with early detection and treatment. Self examination should be encouraged, and educational materials should be made available to interested patients.

■ Prostate Specific Antigen (PSA)

Prostate cancer is the second most common type of cancer in men, after skin cancer. The PSA test is a screening test for prostate cancer. Male uniformed personnel who are considered to be at an increased risk for prostate cancer, such as those who have a family history of prostate cancer or are of African-American heritage, shall have a PSA test annually beginning at 40 years old. All other male uniformed personnel shall have annual PSAs beginning at 50 years old. Several non-cancerous conditions might result in elevated PSA levels including benign prostatic hypertrophy (BPH) and inflammation, or recent prostate gland stimulation resulting from a DRE or ejaculation. Current consensus also highlights the importance of measuring and comparing PSA results over time, known as PSA velocity, where an increase over time would indicate higher

risk for prostate cancer, the magnitude of this increase where risk is increased should be in accordance with current national urological association guidelines.

■ Digital Rectal Examination (DRE)

Any abnormal DRE for male uniformed personnel which could be suggestive of cancer, even if PSA is in a normal range, should be referred to an urologist for a diagnostic workup.

■ Fecal Occult Blood Testing

Fecal occult blood testing is used to screen for colorectal cancer. Testing is done annually in conjunction with the DRE. It is done either in the clinician's office using a stool guaiac card or with stool specimens collected by the patient at home that are applied to the guaiac cards and later analyzed by a laboratory. Multiple different stool samples, usually three, from different days can increase the sensitivity of this colorectal cancer screening test. Diet restrictions do apply to this test.

■ Colonoscopy

Uniformed personnel are exposed to a variety of particulate materials, chemicals and asbestos which can increase the risk for colon cancer. Colonoscopies are used to examine the full lining of the colon and rectum. During the colonoscopy other minor procedures including polyp removal or excising a small piece of tissue for biopsy may be performed. Colonoscopies shall be conducted on all uniformed personnel at 40 years old and repeated every five years. A colonoscopy shall also be performed, regardless of age or schedule, when FOB results are positive or when there is a consistent change in bowel habits.

■ Bladder Cancer Test

As the body absorbs cancer-causing chemicals, they are transferred to the blood, filtered out by the kidneys, and expelled from the body in urine. High concentrations of chemicals in urine can damage the endothelial lining of the bladder and increase the risk of cancer. Because fire fighters are regularly exposed to smoke and chemical fumes, they may be at an increased risk for transitional cell carcinoma (TCC), a cancer of the bladder. Urine is evaluated annually for blood (hematuria), nuclear matrix protein 22 (NMP22) or for telomerase, an enzyme found in bladder cancer cells. Positive dipstick for hematuria, telomerase or NMP22 may indicate referral for upper tract imaging, cystoscopy and urine cytology.

IMMUNIZATIONS

Uniformed personnel must receive, or provide documentation of having received the following vaccinations: Hepatitis A, Hepatitis B, Tetanus/Diphtheria, Pertussis, influenza, MMR, Polio, and Human Papillomavirus (HPV). Pneumovax should be considered for individuals with appropriate risk factors

■ Hepatitis A

Formalin inactivated vaccines made from attenuated HAV strains have been shown to be immunogenic, safe, and highly effective in preventing Hepatitis A. Previous recommendations only included vaccinations for "high risk" uniformed personnel (e.g., HazMat, USAR, and SCUBA) and those uniformed personnel who are Hepatitis C positive or have exposure to contaminated water. However, since all uniformed personnel are potentially exposed to contaminated water via floods or accumulated water from fire suppression, all uniformed personnel shall be vaccinated. The vaccine is 99-100 percent effective, so serum titers after vaccination are not recommended.

A new combined Hepatitis A and B vaccination is now available. Immune globulin (IG) contains anti-HAV with antibody concentration sufficient to be protective. It is to be administered to uniformed personnel who have not been previously vaccinated before exposure or during the early incubation period. Immune globulin may not prevent infection, but will weaken the effects and may render the infection inapparent.

■ Hepatitis B

Uniformed personnel, by the nature of their occupation, are considered high risk and are therefore required to have this vaccine. The vaccine is effective in preventing HBV infection. Among the less than 90 percent who develop adequate antibody levels after the third dose, vaccine effectiveness is virtually 100 percent. Although antibody levels decrease with time, people with normal immune systems continue to be protected from infection.

Despite the decline of antibody levels with time, routine booster doses and serologic monitoring are not presently recommended for patients with normal immune status. Booster doses are not recommended if a previously vaccinated person with documented immunity is exposed to a known source and if the antibody is now inadequate. Nevertheless, HBV booster can be administered, depending on the protocol. If vaccination was not successful, then hepatitis B gammaglobulin must be administered after each exposure. If initial vaccine doses are not sufficient, up to three additional doses can be administered. The following factors — male, over 40 years old, smoker and obesity — are associated with difficulty in HBV antibody conversion following vaccination.

■ Tetanus/Diphtheria

Tetanus and diphtheria occur almost entirely in unimmunized or incompletely immunized persons. Case fatality rates for tetanus are as high as 30 percent and as high as 5 to 10 percent for diphtheria. Immunization records of prior vaccinations are required. Uniformed personnel shall be given tetanus/diphtheria boosters every ten years. For certain high risk wounds, a booster shall be given if five years have elapsed since the last vaccine. Epidemiological studies have indicated that adult immunity to pertussis, whooping cough, is waning. A convenient way to prevent outbreaks of pertussis is to administer a combination Tetanus/Diphtheria/Pertussis vaccine (TDAP).

■ Influenza

The influenza vaccine is 30-40 percent effective in preventing clinical illness and 80 percent effective in preventing death in older adults. Uniformed personnel are in close contact with the public and live in close quarters while on duty and therefore the vaccine is required and must be provided annually, early fall through early winter, for all uniformed personnel.

■ Measles, Mumps, Rubella (MMR)

Measles remains a significant health problem with recent outbreaks attributed to vaccine failure, waning immunity, and erroneous documentation of previous vaccination. Mumps has been increasing in incidence. Use of the rubella vaccine has led to a significant decrease in the incidence of rubella. Rubella is usually a mild illness. However, in pregnant women particularly in the first trimester, it can lead to miscarriage, stillbirth, and congenital rubella syndrome (CRS).

> ***Measles*** — the measles vaccine is required for all uniformed personnel born in or after 1957, if there is no medical contraindication and no evidence of at least one dose of live vaccine on or after the individual's first birthday. In addition, a vaccination is needed if there is no documentation of a physician-diagnosed disease or if there is no laboratory evidence of immunity. Those born prior to 1957 are presumed to be immune. If in doubt, immunization is appropriate.
>
> ***Mumps*** — the mumps vaccine is required for all uniformed personnel who have no documentation of physician-diagnosed mumps, no adequate immunization with live mumps after their first birthday, and no evidence of laboratory immunity. Uniformed personnel born before 1957 are presumed to be immune. Vaccination is needed for uniformed personnel who are unsure of their mumps vaccination history.
>
> ***Rubella*** — the rubella vaccine is required for uniformed personnel unless proof of immunity is available. Women who receive the vaccine should not become pregnant for three months after the vaccination is administered.

■ Polio

The polio vaccine has dramatically reduced the annual number of reported cases of paralytic poliomyelitis. The vaccine series is usually given in childhood. It shall be given to uniformed personnel if the vaccination or disease is not documented.

■ Human Papillomavirus (HPV)

The HPV vaccine shall be provided to all women uniformed personnel up to 26 years old, if previous vaccination is not documented.

■ Varicella

Varicella disease, or chickenpox, is a highly contagious childhood disease caused by varicella virus (VZV). A vaccine is now available. As recommended by the American Committee on Immunization Practices (ACIP), susceptible persons 13 years old and older who come into contact with those at high risk for serious complications from VZV disease (e.g., health care workers and those in contact with immunocompromised individuals) should be vaccinated with two doses at least one month apart. Uniformed personnel who have not had varicella are considered high risk due to their occupational exposures.

Uniformed personnel should be screened for immunity levels. The varicella vaccine shall be offered to all non-immune personnel. If immunity to VZV is not documented, gamma globulin may be indicated after exposure.

INFECTIOUS DISEASE SCREENING

■ Hepatitis C Virus

Hepatitis C is a major health concern for employees in the fire service. It is very important to screen for the antibody to the Hepatitis C virus because it can be clinically silent for decades while causing ongoing damage to the liver. Historically, the vast majority of Hepatitis C infections were caused by blood transfusions or IV drugs use.

The prevalence of Hepatitis C infections in the fire service has varied considerably where it has been measured. Medical studies have suggested that new infection (seroconversion) with the HCV in fire service employees is almost always caused by percutaneous injury events such as with contaminated needle sticks. Baseline antibody tests shall be done on all uniformed personnel to check for previous infection or to establish the absence of infection. Be aware that false positive and false negative results may occur. If conversion from negative to positive occurs, expert consultation for specialized treatment protocols is required.

■ Tuberculosis (TB)

TB control depends upon screening high-risk populations and providing preventive therapy to those most likely to develop active disease. Uniformed personnel, by nature of their occupation, are considered to be at increased risk and an annual PPD is required. A new serum test is available and may be considered as an alternative to PPD. If annual conversion rates are high in a given work group, then testing is recommended every six months. A conversion indicates recent exposure to or infection by, the tubercle bacillus. Personnel will then need appropriate follow-up and contact investigation as medically indicated. As recommended by the American Thoracic Society and Centers for Disease Control and Prevention, chest X-ray and isoniazid prophylaxis may be needed.

■ Human Immune Deficiency Virus (HIV)

HIV testing is not a part of baseline or annual physicals. However, the test should be offered on a confidential basis

as part of post-exposure protocols and as requested by a physician and patient. All results from HIV tests are provided directly to the patient and will not be maintained in any local or international database.

REFERRAL TO HEALTH CARE PRACTITIONERS

The following will warrant referrals to health care practitioners: abnormal findings on the annual medical exam must be addressed by a medical practitioner follow-up or referral; revaccination or intervention following exposures must be managed by a medical practitioner follow-up or referral; managed care or other provider referrals are appropriate for non-work related medical issues; follow-up on findings from annual examinations must be reviewed by the fire department physician; and return to work determinations require clearance by the fire department physician in conjunction with other specialty evaluations, as needed. The fire department physician will normally function as the "gatekeeper" for medical certification, retaining final authority for return to work/fitness for duty decisions.

WRITTEN FEEDBACK

Written feedback to uniformed personnel concerning health risks and health status is required following the annual examination. Reporting findings and risks and suggesting plans for modifying risks improves the physician-patient relationship and helps uniformed personnel claim ownership of their health.

■ Individualized Health Risk Appraisal

Individualized health risk appraisals must also include questions that attempt to accurately measure the uniformed personnel's perception of their health. Health perception can be a useful indicator of potential problems.

DATE COLLECTION AND REPORTING

Comprehensive confidential aggregated medical and health information will be collected for the purposes of this Initiative. The complete data protocol is found in Chapter Seven. The following is an overview of the different categories of data to be compiled: demographics, employment status, illness and injury experience, tobacco and alcohol use, current health status, cancer screening, physical activity, physical measurements, lab data, immunizations, and fitness testing.

■ Occupational Exposure

An integrated exposure database that provides the fire department physician timely information on uniformed personnel aids in tracking diseases in individuals and risks in the population. The physician must educate uniformed personnel on the importance of documenting exposures and follow-up care to ensure that the employee gets necessary medical care. The central departmental database on uniformed personnel must include the following: chemical exposures, physical exposures, biological exposures, and all safety and health related incidents. ■